Journal of
THERMAL BIOLOGY

Editors:

K. BOWLER (U.K.) J. E. HEATH (U.S.A.)

VOLUME CONTENTS, AUTHOR AND SUBJECT INDEXES

Volume 12 (1987)

PERGAMON PRESS

Oxford · New York · Beijing
Frankfurt · São Paulo · Sydney · Tokyo · Toronto

Journal of
THERMAL BIOLOGY

Editors:

K. BOWLER (U.K.) J. E. HEATH (U.S.A.)

VOLUME CONTENTS, AUTHOR AND SUBJECT INDEXES

Volume 12 (1987)

PERGAMON PRESS

Oxford · New York · Beijing
Frankfurt · São Paulo · Sydney · Tokyo · Toronto

Journal of Thermal Biology

Editors

PROFESSOR K. BOWLER: *Department of Zoology*
University of Durham
Durham DH1 3LE, England

PROFESSOR J. E. HEATH: *Department of Physiology and Biophysics, University of Illinois*
Urbana, IL 61801, U.S.A.

Members of the Editorial Board

J. BLIGH (*Fairbanks*)
R. W. CASTENHOLZ (*Eugene*)
B. M. FREEMAN (*Houghton*)
C. GALE (*Washington*)
J. N. R. GRAINGER (*Dublin*)
M. IRIKI (*Yamanashi*)
D. JANKOWSKY (*Kiel*)
K. Y. H. LAGERSPETZ (*Turku*)
A. MALAN (*Strasbourg*)
C. L. PROSSER (*Urbana*)
J. K. RAISON (*Macquarie*)
A. H. ROSE (*Bath*)
J. STOLWIJK (*Yale*)

Aims and Scope

The journal will publish results of work in which the central theme is the mechanisms by which temperature affects living organisms. It will be wide in scope and include studies at the biochemical and physiological level and also at the level of the organism. The following are examples of the subject areas to be covered:

- Studies on the mechanisms involved in acclimation and acclimatization to temperature in plants and animals, including the phenomena of hibernation, dormancy, aestivation and diapause.
- The mechanisms of cellular heat and cold injury, and of the resistance of organisms to extremes of temperature.
- Effects of temperature on growth and development, ageing and life-span.
- Effects of temperature on micro-organisms.
- Behavioural and physiological regulation of body temperature.
- Medical applications of hypo- and hyperthermy, excluding descriptive clinical studies and case-histories.
- Review articles.

Publishing Office
Journals Production Unit, Pergamon Press plc, Hennock Road, Marsh Barton, Exeter, Devon EX2 8NE, England (*Tel.* Exeter (0392) 51558; *Telex* 42749)

Subscription and Advertising Offices
North America: Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, NY 10523, U.S.A.
Rest of the World: Pergamon Press plc, Headington Hill Hall, Oxford OX3 0BW, England (*Tel.* Oxford (0865) 64881).

Subscription Rates
Annual institutional subscription rate (1988) DM 355.00; 2-year institutional rate (1988/89) DM 674.50; personal subscription rate for those whose library subscribes at the regular rate (1988) DM 139.00. Prices are subject to amendment without notice.

Microform Subscriptions and Back Issues
Back issues of all previously published volumes are available in the regular editions and on microfilm and microfiche. Current subscriptions are available on microfiche simultaneously with the paper editions and on microfilm on completion of the annual index at the end of the subscription year.

Published quarterly.

Copyright © 1988 Pergamon Press plc

It is a condition of publication that manuscripts submitted to this journal have not been published and will not be simultaneously submitted or published elsewhere. By submitting a manuscript, the authors agree that the copyright for their article is transferred to the publisher if and when the article is accepted for publication. However, assignment of copyright is not required from authors who work for organizations which do not permit such assignment. The copyright covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microform or any other reproductions of similar nature and translations. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, electrostatic, magnetic tape, mechanical photocopying, recording or otherwise, without permission in writing from the copyright holder.

Photocopying information for users in the U.S.A. The Item-fee Code for this publication indicates that authorization to photocopy items for internal or personal use is granted by the copyright holder for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service provided the stated fee for copying, beyond that permitted by Section 107 or 108 of the United States Copyright Law, is paid. The appropriate remittance of $3.00 per copy per article is paid directly to the Copyright Clearance Center Inc., 21 Congress Street, Salem, MA 01970.

Permission for other use. The copyright owner's consent does not extend to copying for general distribution, for promotion, for creating new works or for resale. Specific written permission must be obtained from the publisher for such copying.

The Item-fee Code for this publication is: 0306-4565/88 $3.00 + 0.00

VOLUME CONTENTS

VOLUME 12, 1987

NUMBER 1

P. Bawa, P. B. C. Matthews and I. B. Mekjavic	1	Electromyographic activity during shivering of muscles acting at the human elbow
K. G. Gebremedhin	5	A model of sensible heat transfer across the boundary layer of animal hair coat
Aidan Sharkey, Peter Elliott, J. M. Lipton and A. H. Giesecke Jr	11	The temperature of the air within the external auditory meatus compared with esophageal temperature during anaesthesia and surgery
R. Krattenmacher and K. Rübsamen	15	Thermoregulatory significance of non-evaporative heat loss from the tail of the coypu (*Myocastor coypus*) and the tammar-wallaby (*Macropus eugenii*)
K. L. Bristow and J. A. Holt	19	Can termites create local energy sinks to regulate mound temperature?
C. T. Araki, R. M. Nakamura and L. W. G. Kam	23	Diurnal temperature sensitivity of dairy cattle in a naturally cycling environment
Walter Randall, J. Thomas Cunningham, Steffanie Randall, John Liittschwager and Ralph F. Johnson	27	A two-peak circadian system in body temperature and activity in the domestic cat, *Felis catus* L.
Joachim Roth, Eugen Zeisberger and Hans-Joachim Schwandt	39	Changes in peripheral metabolism of catecholamines in guinea-pig during thermal adaptation
A. Haim	45	Thermoregulation and metabolism of Wagner's gerbil (*Gerbillus dasyurus*): a rock dwelling rodent adapted to arid and mesic environments
Obituary	i	Professor B. P. Ushakov (1916–1986)
Call for Papers	iii	

NUMBER 2

H. Craig Heller	v	Foreword

Biochemical and Cellular Aspects of Cold Adaptation and Acclimation

John H. Becker	49	Relative cold resistance of potassium cotransport and pump systems in ground squirrel and guinea pig kidney cultures
D. D. Belke, D. J. Pehowich and L. C. H. Wang	53	Seasonal variation in calcium uptake by cardiac sarcoplasmic reticulum in a hibernator, the Richardson's ground squirrel
J. Ennen, G. Kuhnen, M. Ernst and P. Petersen	57	Effects of systemic treatment of a hibernator and a non-hibernator with bacterial lipopolysaccharide (LPS)
A. C. Hall, M. W. Wolowyk, L. C. H. Wang and J. C. Ellory	61	The effects of temperature on Ca^{2+} transport in red cells from a hibernator (*Spermophilus richardsonii*)
T. R. Hynes and J. S. Willis	65	Metabolic regulation of low K^+ permeability in cold-stored erythrocytes: role of calcium ion and reduced glutathione

Liu Jin-Rong, Liu Yuan, Chen Zuo and Hwang Ping-Bo	69	Comparison of cold tolerance in cerebral cortical neurons of hibernators and non-hibernators
T. F. Lee and Lawrence C. H. Wang	73	Substrate specificity on enhancement of aminophylline-stimulated thermogenesis
Bin Liu, Ming-ji Zhao and Iping Chao	77	Effect of cold on transmembrane potentials in cardiac cells of the hedgehog
H. Rahmann, R. Hilbig, J. Marx, H. Beitinger and R. Mehlfeld	81	Brain gangliosides and hibernation
M. W. Wolowyk, M. C. Li-Kwong-Ken and L. C. H. Wang	87	Regulation of smooth muscle voltage sensitive Ca^{2+} channels during hibernation in the ground squirrel (*Spermophilus richardsonii*)
		Thermoregulation
A. R. Gwosdow and L. G. Berglund	91	Clothing distribution influences thermal responses of men in cool environments
J. M. Horowitz, M. P. Thomas and P. Eckerman	97	Thermal dependence of neural activity in the hamster hippocampal slice preparation
G. Kuhnen, B. Wloch and W. Wünnenberg	103	Effects of acute hypoxia and/or hypercapnia on body temperatures and cold induced thermogenesis in the golden hamster
Kiyoshi Matsumura and Teruo Nakayama	109	Local cooling suppresses supraoptic neurosecretory cells *in vivo* and *in vitro*
K. Pleschka, M. Hashimoto, U. Sommerlad and I. Lärkens	113	Distribution of facial and nasal blood flow in the cold loaded dog
		Neural and Endocrine Aspects of Hibernation and Seasonal Cycles
H. Pohl	119	Control of annual rhythms of reproduction and hibernation by photoperiod and temperature in the Turkish hamster
H. Pohl and H. Giedke	125	Natural hibernation—an animal model for seasonal affective disorder?
P. D. Rismiller and G. Heldmaier	131	Melatonin and photoperiod affect body temperature selection in the lizard *Lacerta viridis*
Kimberley A. Ruit, David S. Bruce, Paul P. Chiang, Peter R. Oeltgen, John R. Welborn and Sita P. Nilekani	135	Summer hibernation in ground squirrels (*Citellus tridecemlineatus*) induced by injection of whole or fractionated plasma from hibernating black bears (*Ursus americanus*)
W. A. Spurrier, P. R. Oeltgen and R. D. Myers	139	Hibernation "trigger" from hibernating woodchucks (*Marmota monax*) induces physiological alterations and opiate-like responses in the primate (*Macacca mulatta*)
Thomas E. Tomasi, Jock S. Hamilton and Barbara A. Horwitz	143	Thermogenic capacity in shrews
		Physiological and Ecological Aspects of Seasonality and Cold Adaptation
Henry J. Harlow	149	Urea-hydrolysis in euthermic hibernators and non-hibernators during periods of food availability and deprivation
Edward E. Southwick	155	Cooperative metabolism in honey bees: an alternative to antifreeze and hibernation
Michael G. Tannenbaum and Edward B. Pivorun	159	Differential effect of food restriction on the induction of daily torpor in *Peromyscus maniculatus* and *P. leucopus*

Steven J. Wiekler, Barbara A. Horwitz and Kayleen S. Kott — 163 Muscle function in hibernating hamsters: a natural analog to bed rest?

Z.-Q. Zhou, W. F. Dryden and L. C. H. Wang — 167 Seasonal and temperature dependent differences in the staircase phenomenon of heart tissues from Richardson's ground squirrel

Hypothermia and Human Responses to Acute Cold

H. Craig Heller, Robert Elsner and Nageswara Rao — 171 Voluntary hypometabolism in an Indian yogi

Michael L. Jourdan and Lawrence C. H. Wang — 175 An improved technique for the study of hypothermia physiology

Jeames A. Wagner and Steven M. Horvath — 179 Cold tolerance of a world class channel swimmer

NUMBER 3

J. R. Layne Jr, D. L. Claussen and M. L. Manis — 183 Effects of acclimation temperature, season, and time of day on the critical thermal maxima and minima of the crayfish *Orconectes rusticus*

Cai Bing and Sun Ruyong — 189 Studies of the mathematical model for postnatal development of thermoregulation

Geoffrey A. Hammerson — 195 Thermal behaviour of the snake *Coluber constrictor* in west-central California

Mark R. Opp, Nigel J. Ball, Don E. Miller and Charles J. Amlaner Jr — 199 Thermoregulation and sleep: effects of thermal stress on sleep patterns of Glaucous-winged gulls (*Larus glaucescens*)

Edward M. Goolish — 203 Cold-acclimation increases the ventricle size of carp, *Cyprinus carpio*

J. Scott Turner — 207 On the transient temperatures of ectotherms

Richard W. Hill and Clifford W. Welsch — 215 Influence of repeated hyperthermia on the early development of carcinogen-induced rat mammary cancers; refinement of a technique for hyperthermia research

A. M. S. Kashmeery and K. Bowler — 221 The effect of heating on the respiration of MC7 and D23 tumour tissue

Kyaw Tha Paw U — 227 Mathematical analysis of the operative temperature and energy budget

P. S. Rutledge, J. R. Spotila and D. P. Easton — 235 Heat hardening in response to two types of heat shock in the lungless salamanders *Eurycea bislineata* and *Desmognathus ochrophaeus*

Announcement — i

NUMBER 4

Andrew A. Young	243	Thermal sensations during simultaneous warming and cooling at the forearm: a human psychophysical study
R. Geers, W. Van der Hel, J. Verhagen, M. Verstegen, V. Goedseels, H. Brandsma, A. Hencken, J. Schöller and D. Berckmans	249	Surface temperatures of growing pigs in relation to the duration of acclimation to air temperature or draught
M. W. A. Verstegen, A. Siegerink, W. Van der Hel, R. Geers and C. Brandsma	257	Operant supplementary heating in groups of growing pigs in relation to air velocity
Roberto Refinetti and Harry J. Carlisle	263	A computational formula for heat influx in animal experiments
Sun Ru-yung and Zeng Jinxiang	267	Postnatal development of thermoregulation in the root vole (*Microtus oeconomus*) and the quantitative index of homeothermic ability
Osamu Shido	273	Day–night variation of thermoregulatory responses to intraperitoneal electric heating in rats
Reinhard Merz and Helmut Laudien	281	Two types of heat tolerance in FHM-cells. Induction by heat-shock versus elevated culturing temperature
K. P. Ivanov, L. Dymnikova and N. Danilova	289	The hypothalamus neurons response to the signals from surface and deep skin thermoreceptors
Alan Clive Marsh	295	Thermal responses and temperature tolerance of a desert ant-lion larva
Hiroko Tsukuda and Bunshin Liu	301	Effect of exogenous lactate on pulsation rate and oxygen consumption of the isolated heart of thermally acclimated goldfish
Announcements	i	

SUBJECT INDEX

Acclimation,
  and CTMin, CTMax in crayfish, 183
  and heart function of goldfish, 301
  cold and ventrical size in carp, 203
  resistance in FHM-cells, 281
  to air temperature and draught, and growth in pigs, 249
Acclimatization,
  and CTMin, CTMax in crayfish, 183
Adaptation,
  and catecholamine metabolism in guinea pigs, 39
Adrenaline, 39
Ambient temperature,
  and body temperature in coypu and a wallaby, 15
  and body temperature in *Gerbillus*, 45
  and body temperature in *Microtus*, 267
  and body temperature in snake, 195
  and diurnal body temperature in cattle, 23
  and ecology of ant-lion larvae, 295
  and heat transfer in calves, 5
  and honeybee cluster temperature, 155
  and physiological performance in an ocean swimmer, 179
  preference in growing pigs, 257
Amphibia, 235
Annual rhythms,
  and hibernation in hamsters, 119, 125
Apis mellifora, 155
Arrhenius plots,
  calcium uptake by heat, 53
Arteriovenous anastomoses, 113

Behaviour,
  changes in a monkey induced by hibernation trigger in woodchuck plasma, 139
  social in bees and cluster thermoregulation, 155
Behavioural thermoregulation,
  by microclimate selection in ant-lion larvae, 295
  in cold-exposed rats, 263
  in *Coluber*, 195
  in growing pigs, 257
  in *Lacerta*, 131
  in termite mounds, 19
Bird, 199, 207
Blood flow,
  distribution of facial in cold loaded dog, 113
Body temperature,
  and activity patterns of cats, 27
  and body fat in the ocean swimmer, 179
  and heat load in rats, 273
  as assessed by esophageal or aural temperature in man, 11
  correlation with thermal sensation in man, 91
  development and in rodents, 189, 267
  effect of hypoxia and for hypercapnia on in hamsters, 103
  effect of woodchuck plasma hibernation trigger on in a monkey, 139
  endotoxin induced increase of in guinea pigs and hamsters, 57
  in cattle in a cycling environment, 23
  in *Coluber*, 195
  in *Gerbillus*, 45
  in the coypu and a wallaby, 15
  lowering of during meditation in Indian yogi, 171
  method for inducing hypothermia in rats and ground squirrels, 175
  models for in ectotherms, 207
  selection in *Lacerta* and melatonin and photoperiod, 131
Bos taurus, 5, 23
Boundary layers,
  in model of heat transfer, 5
Brain,
  gangliosides in hibernators, 81
Brown adipose tissue,
  thermogenic capacity of in a shrew and rodents, 143

Calcium, 49, 53, 61
  channels in smooth muscle of hibernators, 87
  role in cardiac excitability in hibernation, 77
  role of in regulation of cell K^+ permeability, 65
Calcium transport,
  in ground squirrel red cells, 61
  in hibernator heart muscle, 53
Calorimetry, 273
Cancer,
  period hyperthermia and, 215
Canis domesticus, 113
Carassius auratus, 301
Catecholamine,
  metabolism and adaptation in guinea pigs, 39
Cavia aperea porcellus, 39, 57, 65, 87
Circadian rhythm,
  of body temperature and activity in cats, 27
  of response to heat load in rats, 273
Circannual rhythms,
  and hibernation in hamsters, 119, 125
Citellus dauricus, 69
Citellus tridecemlineatus, 49, 135
Citrate synthase,
  activity of in muscle in hibernation, 163
Clothing,
  influence on thermal response in cool environment, 91
Coat,
  density of and heat transfer, 5
  model for heat transfer through, 5
Cold exposure,
  behavioural response to in rats, 263
Cold load,
  and thermoregulation in gulls, 199
  effect on distribution of facial and nasal blood flow in dog, 113
Cold sensitivity,
  lack of in ion transport in ground squirrel cells, 49, 61
  of cardiac cells of hedgehog, 77
  of ion transport in guinea pig cells, 49, 65
  of smooth muscle Ca^{2+} channels and hibernation, 87
  of supraoptic nucleus cells, 109
Cold storage,
  and K^+ permeability of red blood cells, 65
Cold tolerance,
  comparison of in cortical neurons in ground squirrel and rat, 69
  in an ocean swimmer, 179
  in hibernator and calcium fluxes, 87
  of bee clusters, 155
  of rats improved by feeding sucrose and aminophylline, 73
Coluber constrictor, 195

Cooling,
and skin thermoreceptor responses, 289
rates in ectotherms, 207
Cortical neurons,
change in cold tolerance of in hibernation, 69
Cricetus cricetus, 77
Crustacea, 183
CTMax,
and heat hardening in lungless salamanders, 235
of *Orconectes*, 183
CTMin,
of *Orconectes*, 183
Cueta trivirgata, 295
Cynomys lecurus, 149
Cynomys ludovicianus, 149
Cyprinus carpio, 203

Desmognathus ochrophaeus, 235
Development,
and body temperature, a model of, 139
of cancer and periodic hyperthermia, 215
of homeothermy in *Microtus*, 267
Diel variation,
in body temperature of *Coluber*, 195
lack of in CTMax, CTMin of crayfish, 183
Diurnal rhythm,
of body temperature in cattle, 23
Drugs, 49, 73, 87, 189, 221

Ectotherm,
transient temperatures of in heating and cooling, 207
Endotoxins, 57
Enzyme, 163, 281
Erinaceus dealbatus, 77
Esterases,
isoenzymes of FHM-cells and culture temperature, 281
Eurycea bislineata, 235
Evaporative heat loss,
in response to heat load in rats, 273

Fat,
body and cold tolerance in an ocean swimmer, 179
Felis catus, 27
Fever,
endotoxin induced in a hibernator and non-hibernator, 57
FHM-cells,
heat tolerance of, 281
Fish, 203, 281, 301
Food restriction,
effect on torpor in *Peromyscus*, 159

Gangliosides,
role in hibernation, 81
GDP binding to BAT mitochondria,
comparison of in shrew and 3 rodents, 143
Gerbillus dasyurus, 45
Glis glis, 81
Glutathione,
a role in K^+ permeability of red blood cells in cold, 65
Growth rate,
and acclimation temperature in carp, 203

Heart,
force-frequency relationship in ground squirrel, 167
membrane excitability and temperature, 77
rate and acclimation in isolated goldfish, 301
rate in an ocean swimmer, 179
rate in rats during heat load, 273
size and acclimation temperature in carp, 203
SR calcium uptake in hibernation, 53
Heat hardening,
and heat shock in lungless salamanders, 235
in FHM-cells, 281
Heat loss,
circadian variation in to heating in rats, 273
from the tail in coypu and a wallaby compared, 15
through animal coat, 5
Heat production,
and cold tolerance in an ocean swimmer, 179
of honey bee clusters, 155
of rats stimulated by feeding sucrose and aminophylline, 73
Heat shock,
induced heat hardening in lungless salamanders, 235
proteins of FHM-cells, 281
Heat storage,
circadian variation in during heat load in rats, 273
Heat tolerance,
of ant-lion larvae, 295
two forms of in FHM-cells, 281
Heat transfer,
mathematical model for, 227
model for across pelage, 5
Heating,
and thermoreceptor response from skin, 289
behavioural work for in cold exposed rats, 263
operant supplemental and wind speed in pigs, 257
rates of in ectotherms, 207
thermoregulatory response to intraperitoneal in rats, 273
Hibernation, 49, 53
and brain ganglioside composition, 81
and enhanced resistance to bacterial endotoxin, 57
and force-frequency relationship in ground squirrel heart, 167
and maintenance of cardiac cell excitability, 77
and muscle function in hibernating hamsters, 163
and red blood cell calcium regulation, 61
change in sensitivity to cold in cortical neurons during, 69
effect of Li^+ on torpor phase in hamsters, 125
effect on calcium uptake by heart muscle SR, 53
induction of in ground squirrels by plasma fraction from hibernating bears, 135
regulation of smooth muscle Ca^{2+} channels during, 87
synchronization with annual rhythms in hamsters, 119
trigger, 135, 139
Hippocampal slice,
temperature dependence of neural activity, 97
Human, 1, 11, 91, 171, 179, 243, 263
β-Hydroxyacyl CoA dehydrogenase,
activity in muscle in hibernation, 163
Hypercapnia,
effect on body temperature in hamsters, 103
Hyperthermia,
periodic and development of cancer, 215
sensitivity to in rat tumour mitochondrial respiration, 221
Hypometabolism,
in Indian yogi, 171
Hypothalamic neurons,
response of to signals from skin thermoreceptors, 289
Hypothermia,
and cold block in cortical neuronal function in a rat and ground squirrel, 69
induced in monkey by hibernation trigger from woodchuck plasma, 139
in Indian yogi during meditation, 171
method for induction of, 175
Hypoxia,
effect on body temperature in hamsters, 103

Insect, 19, 155, 295

Insulation,
asymmetric and thermal sensation in man, 91
Ion transport,
and cold in guinea pig red blood cells, 65
in ground squirrel heart muscle, 53
in ground squirrel red blood cells, 61
lack of sensitivity to cold in ground squirrel kidney cells, 49

Lacerta viridis, 131
Lactate,
content of heart and acclimation in goldfish, 301
Lactate dehydrogenase,
lack of effect of culture temperature on in FHM-cells, 281
Larus glaucescens, 199
Lipopolysaccharide bacterial, 57
Lithium,
modification of torpor or hibernation by in hamsters, 125

Macacca mulatta, 139
Macropus eugenii, 15
Mammal, 1, 5, 11, 15, 23, 27, 39, 45, 49, 53, 57, 61, 65, 69, 73, 77, 81, 91, 97, 103, 109, 113, 119, 125, 135, 139, 143, 149, 163, 167, 171, 175, 179, 189, 215, 221, 243, 249, 257, 263, 267, 273, 289
Marmota flaviventris, 149
Marmota monax, 139
Marsupial, 15
Melatonin,
mediation of photoperiodic selection of body temperature in lizards, 131
Membrane,
cardiac cell excitability and hibernation, 77
Mesocricetus auratus, 57, 97, 103, 163
Mesocricetus brandti, 119, 125
Metabolic heat production,
capacity in muscle of hibernating hamsters, 163
in coypu, 15
in *Gerbillus*, 45
in honeybee clusters, 155
in rats in response to heat load, 273
in wallaby, 15
Metabolism,
of honeybee clusters as a function of temperature, 155
of isolated goldfish heart and thermal acclimation, 301
of *Microtus*, *Peromyscus*, *Reithrodontomys* and *Sorex*, 143
reduced in Indian yogi during meditation, 171
3-Methoxy-4-hydroxyphenylglycole, 39
Microtus montanus, 143
Microtus oeconomus, 267
Mitochondria,
GDP binding to in brown fat, 143
respiration and hyperthermia in rat tumours, 221
Model,
animal for hypothermia, 175
animal for seasonal affective disorder, 125
for heat influx in behavioural thermoregulation in rats, 263
for heating and cooling in ectotherms, 207
for post-natal development of body temperature, 189
mathematical for operative temperature, 227
of sensible heat transfer, 5
Mus musculus, 81
Muscle,
function in hibernating hamsters, 163
response to cold in smooth of hibernators and non-hibernators, 87
Myocastor coypus, 15

Non-shivering thermogenesis,
capacity in a shrew and 3 rodents, 143
in a gerbil, 45
threshold temperatures of in hamsters, 103
Noradrenaline, 39, 45, 143

Ocymyrmex robustior, 295
Operative temperature,
mathematical model for, 227
Opioid-like properties,
of hibernation trigger from woodchuck plasma, 139
Orconectes rusticus, 183
Oryctolagus cuniculus, 289

Panting,
and heat stress in gulls, 199
Peripheral blood flow,
in Indian yogi during meditation, 171
in ocean swimmers in cold, 179
Peromyscus leucopus, 159
Peromyscus maniculatus, 143, 159
Phodopus sungorus, 81
Photoperiod,
and body temperature selection in *Lacerta*, 131
and hibernation in hamsters, 163
cycles of and hibernation in hamsters, 119
Pimephales promelas, 281
POAH,
neuron response to stimulation of skin thermoreceptors, 289

Rattus sp., 69, 73, 103, 149, 175, 215, 221, 263, 273
Red blood cells,
calcium transport of and hibernation, 61
guinea pig and K^+ permeability in cold, 65
Reithrodontomys megalotis, 143
Reproduction,
annual rhythms of and hibernation in hamsters, 119
Reptile, 131, 195, 207

Sarcoplasmic reticulum,
and calcium uptake in hibernation, 53
Shivering,
and cold loading in gulls, 199
electromyograms during in man, 1
threshold temperatures of in hamsters, 103
Skin temperature,
and clothing insulation in man, 91
and response of hypothalamic neurons, 289
and thermal sensation in man, 243
effect of acclimation to air temperature and draught on in growing pigs, 249
in response to heat load in rats, 273
Skin thermoreceptors,
latency of response to stimulation of by hypothalamic neurons, 289
Sleep,
and thermoregulation in gulls, 199
Sovex vagrans, 143
Spermophilus lateralis, 175
Spermophilus richardsonii, 53, 61, 167
Spermophylus elegans, 149
Spermophylus tridescemlineatus, 149
Suis suis, 249, 257

Taxidea taxus, 149
Temperature,
dependence of hippocampal slice neural activity, 97
effect of calcium transport in red blood cells, 61
effect on calcium transport in heart SR, 53
effect on hedgehog cardiac cell potentials, 77
environmental and ecology of ant-lion larvae, 295

Thermal conductance,
circadian variation in in rats, 273
in a desert gerbil, 45
Thermal sensation,
and clothing in man in cool environments, 91
and skin temperature in man, 243
Thermal stress,
and sleep in gulls, 199
Thermoregulation,
and photoperiod in *Lacerta*, 131
and shivering in man, 1
and sleep in gulls, 199
behavioural by ant-lion larvae, 295
behavioural in *Coluber*, 195
behavioural in growing pigs, 257
circadian variation in response to heating in rats, 273
development of capacity for, a model of, 189, 267
in a desert gerbil, 45
in an ocean swimmer, 179
role of tail in a coypu and a wallaby, 15
Thermotolerance,
two forms of FHM-cells, 281
Torpor,
induced by food restriction in *Peromyscus*, 159
induced in ground squirrels by plasma fraction from bears, 135
inhibition of in hamsters by lithium therapy, 125
Tumulitermes pastinator, 19

Urea metabolism,
by gut bacteria during fasting, 149
Ursus americanus, 135

Wind,
effect on heat transfer through coat, 5
effect on preferred air temperature in pigs, 257

Yogi,
change in body temperature during meditation, 171

AUTHOR INDEX

Amlaner C. J. Jr, 199
Araki C. T., 23

Ball N. J., 199
Bawa P., 1
Becker J. H., 49
Beitinger H., 81
Belke D. D., 53
Berckmans D., 249
Berglund L. G., 91
Bin Liu, 77
Bowler K., 221
Brandsma C., 257
Brandsma H., 249
Bristow K. L., 19
Bruce D. S., 135

Cai Bing, 189
Carlisle H. J., 263
Chen Zuo, 69
Chiang P. P., 135
Claussen D. L., 183
Cunningham J. T., 27

Danilova N., 289
Dryden W. F., 167
Dymnikova L., 289

Easton D. P., 235
Eckerman P., 97
Elliott P., 11
Ellory J. C., 61
Elsner R., 171
Ennen J., 57
Ernst M., 57

Gebremedhin K. G., 5
Geers R., 249, 257
Giedke H., 125
Giesecke A. H. Jr, 11
Goedseels V., 249
Goolish E. M., 203
Gwosdow A. R., 91

Haim A., 45
Hall A. C., 61
Hamilton J. S., 143
Hammerson G. A., 195
Harlow H. J., 149
Hashimoto M., 113
Heldmaier G., 131
Heller H. C., 171
Hencken A., 249
Hilbig R., 81
Hill R. W., 215
Holt J. A., 19

Horowitz J. M., 97
Horvath S. M., 179
Horwitz B. A., 143, 163
Hwang Ping-Bo, 69
Hynes T. R., 65

Iping Chao, 77
Ivanov K. P., 289

Johnson R. F., 27
Jourdan M. L., 175

Kam L. W. G., 23
Kashmeery A. M. S., 221
Kott K. S., 163
Krattenmacher R., 15
Kuhnen G., 57, 103

Laudien H., 281
Layne J. R. Jr, 183
Lee T. F., 73
Liittschwager J., 27
Li-Kwong-Ken M. C., 87
Lipton J. M., 11
Liu B., 301
Liu Jin-Rong, 69
Liu Yuan, 69
Lürkens I., 113

Manis M. L., 183
Marsh A. C., 295
Marx J., 81
Matsumura K., 109
Matthews P. B. C., 1
Mehlfeld R., 81
Mekjavic I. B., 1
Merz R., 281
Miller D. E., 199
Ming-ji Zhao, 77
Myers R. D., 139

Nakamura R. M., 23
Nakayama T., 109
Nilekani S. P., 135

Oeltgen P. R., 135, 139
Opp M. R., 199

Paw U K. T., 227
Pehowich D. J., 53
Petersen P., 57
Pivorun E. B., 159
Pleschka K., 113
Pohl H., 119, 125

Rahmann H., 81

Randall S., 27
Randall W., 27
Rao N., 171
Refinetti R., 263
Rismiller P. D., 131
Roth J., 39
Rübsamen K., 15
Ruit K. A., 135
Rutledge P. S., 235

Schöller J., 249
Schwandt H.-J., 39
Sharkey A., 11
Shido O., 273
Siegerink A., 257
Sommerlad U., 113
Southwick E. E., 155
Spotila J. R., 235
Spurrier W. A., 139
Sun Ruyong, 189
Sun Ru-yung, 267

Tannenbaum M. G., 159
Thomas M. P., 97
Tomasi T., 143
Tsukuda H., 301
Turner J. S., 207

Van der Hel W., 249, 257
Verhagen J., 249
Verstegen M. W. A., 249, 257

Wagner J. A., 179
Wang L. C. H., 53, 61, 73, 87, 167, 175
Welborn J. R., 135
Welsch C. W., 215
Wickler S. J., 163
Willis J. S., 65
Wloch B., 103
Wolowyk M. W., 61, 87
Wünnenberg W., 103

Young A. A., 243

Zeisberger E., 39
Zeng Jinxiang, 267
Zhou Z.-Q., 167